Basic Laboratory Gas Ebullition Test Protocol

1) Establish chemical composition of the DNAPL sample provided by Brown and Caldwell. A DNAPL sample of 200 to 250 ml will be conveyed to the ERDC lab by Jacobs after picking up the sample from Brown and Caldwell. Characterization *may* have already been performed adequately by Brown and Caldwell, though we may want to repeat this analysis as a check for this batch of DNAPL. It is important to know the relative proportion of VOC and PCB within the DNAPL. If the available DANPL appears to have a higher VOC content than we believe is in the sediments, then we may want to adjust the DNAPL composition for the purposes of the study.

2) Column study will entail setting up an 8-inch or 10-inch diameter column with sediment and cap material (using the presumed cap design at the time of testing). The general design of the column test will entail construction of a the column with the following materials, starting from the bottom of the column:

   a. a geotextile at bottom of column;
   b. approximately 1-inch layer of gravel above geotextile where air (i.e., the simulated gas) is "injected" into the column;
   c. then a frit or perforated plexiglass to distribute the air into the column;
   d. then approximately a 6-inch layer of Harbor mud/sediment;
   e. then the cap material(s) atop the sediment; and
   f. space for water to be present above the top of the cap.

Are NAPL?

~2 diff. levels of PCBs, but same gas rate

3) Propose to set up two columns, one from a heavily contaminated portion of the sediment with higher gas ebullition rates (based on field observations), and one from another, less contaminated location. → make sure quantify PCB levels! - total Aroclor - v VOCs → JE

7 day test

4) When the column is "packed" / setup, it will be important to carefully allow the sediment to consolidate due to the weight of the cap materials. (Paul S. from ERDC indicates that consolidation should be "complete" within a few days of column packing.)

5) Initial column test: after columns are setup and consolidated, pump air through the column and observe whether NAPL becomes apparent in the water above the top of the cap.

tracer only

6) 2nd column test: Add methylene blue dye (through injection ports) to the gravel layer, and observe appearance of the dye presence in the water overlying the cap during air/gas pumping.

~50 ml ?

7) 3rd column test: inject DNAPL from the site into the sediment above the gas distribution apparatus (using a syringe and ports already present in the column) and observe whether NAPL appear in the water above the cap during air/gas pumping. (Note: not sure whether we do this in both columns or just one. It may depend on the behavior of the columns during the previous tests.)

8) These basic tests should be complete ~~of initiation~~ of the lab study.

Follow-on Tests or Additional Possible Tests:

The following optional tests will depend upon the nature of the results and observations from the Basic tests.

- Testing of the water above the cap for dissolved VOCs and PCBs. PCBs could be assessed by field test kit screening methods. Alternatively, ERDC can perform the laboratory analytical (not in the sediment lab where the columns will be, or we can have the sediment samples shipped to the lab of our choosing.)
- Add layers of cap materials if NAPL is observed above the basic cap (e.g., organo-clay layer). Then re-perform the column tests.
- Disassemble and "section" the cap materials to determine the degree of migration of PCBs and/or VOCs up into the cap after the test period. This would involve laboratory analytical testing of the sediments. ERDC can perform the analytical (not in the sediment lab where the columns will be, or we can have the sediment samples shipped to the lab of our choosing.)
- We could add advective water flow to the testing (i.e., water flow up the column) to simulate this flux mechanism as well.

Notes on costs:

- The final cost will, of course depend on what we do. But, Paul seemed to think that the costs for the basic testing would be in the range of $30K to $40K. However, if the column(s) become too contaminated to use for future work at the ERDC lab, then they would want the columns replaced at a cost of approximately $10,000 per colum.